

WHAT IS CLAIMED IS:

1. A method for integrated decision support,  
comprising the steps of:

receiving a plurality of decision inputs;

5 converting a first plurality of said received  
decision inputs to a plurality of graph representations;

converting a second plurality of said received  
decision inputs to a plurality of mathematical  
representations;

10 decomposing said converted first plurality of said  
received decision inputs and said converted second  
plurality of said received decision inputs to a plurality  
of sub-problems;

15 detecting a plurality of strongly-connected  
components associated with said plurality of sub-  
problems; and

solving said plurality of sub-problems.

2. The method of Claim 1, wherein the decomposing  
20 step further comprises the steps of:

performing dependency propagation for said plurality  
of sub-problems; and

placing said plurality of sub-problems in at least  
one predefined order for solution.

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3. The method of Claim 1, wherein the detecting  
step comprises executing a graph-theoretic algorithm for  
a plurality of mathematical equations associated with  
said plurality of strongly-connected components to  
30 prevent over-constraining.

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4. The method of Claim 1, wherein the decomposing step comprises decomposing said converted first plurality of said received decision inputs and said converted second plurality of said received decision inputs to a plurality of mathematical equations and algebraically solvable graph components.

5. The method of Claim 1, wherein the detecting step comprises detecting a plurality of coupled relations.

6. The method of Claim 1, wherein the detecting step comprises identifying a plurality of simultaneous equations.

7. The method of Claim 1, wherein the solving step comprises solving a plurality of numerical sub-problems and a plurality of algebraic sub-problems.

8. The method of Claim 1, wherein said solving step comprises:

solving a plurality of numerical relations sub-problems with a numerical solution algorithm;

solving a plurality of geometric relations sub-problems with an algebraic solution algorithm; and

solving a plurality of logical relations sub-problems with a logical inference solution algorithm.

9. The method of Claim 1, wherein said plurality of decision inputs comprises at least one of:

- a plurality of option selection parameters;
- a plurality of equality relation parameters;
- 5 a plurality of dependency parameters;
- a plurality of production rule parameters;
- a plurality of logical relation parameters;
- a plurality of inequality expression parameters; and
- 10 a plurality of geometric constraint parameters.

10. The method of Claim 1, wherein the solving step comprises solving a plurality of simultaneous equations with a Newton-Raphson algorithm or Modified Gram-Schmidt algorithm.

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11. Software for integrated decision support, the software being embodied in a computer-readable medium and when executed operable to:

receive a plurality of decision inputs;

5       convert a first plurality of said received decision inputs to a plurality of graph representations;

convert a second plurality of said received decision inputs to a plurality of mathematical representations;

10       decompose said converted first plurality of said received decision inputs and said converted second plurality of said received decision inputs to a plurality of sub-problems;

detect a plurality of strongly-connected components associated with said plurality of sub-problems; and

15       solve said plurality of sub-problems.

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12. A computer-implemented system for integrated decision support, comprising:

a processor; and

a data storage device coupled to said processor,  
said processor operable to:

receive a plurality of decision inputs;

convert a first plurality of said received decision inputs to a plurality of graph representations;

convert a second plurality of said received decision inputs to a plurality of mathematical representations;

decompose said converted first plurality of said received decision inputs and said converted second plurality of said received decision inputs to a plurality of sub-problems;

detect a plurality of strongly-connected components associated with said plurality of sub-problems; and

solve said plurality of sub-problems.

13. The system of Claim 12, wherein said processor is further operable to:

perform dependency propagation for said plurality of sub-problems; and

place said plurality of sub-problems in at least one predefined order for solution.

14. The system of Claim 12, wherein said processor is further operable to execute a graph-theoretic algorithm for a plurality of mathematical equations associated with said plurality of strongly-connected components to prevent over-constraining.

15. The system of Claim 12, wherein said processor is further operable to decompose said converted first plurality of said received decision inputs and said converted second plurality of said received decision inputs to a plurality of mathematical equations and algebraically solvable graph components.

16. The system of Claim 12, wherein said processor is further operable to detect a plurality of coupled relations.

17. The system of Claim 12, wherein said processor is further operable to identify a plurality of simultaneous equations.

18. The system of Claim 12, wherein said processor is further operable to solve a plurality of numerical sub-problems and a plurality of algebraic sub-problems.

19. The system of Claim 12, wherein said processor is further operable to:

solve a plurality of numerical relations sub-problems with a numerical solution algorithm;

solve a plurality of geometric relations sub-problems with an algebraic solution algorithm; and

solve a plurality of logical relations sub-problems with a logical inference solution algorithm.

20. The system of Claim 12, wherein said plurality of decision inputs comprises at least one of:

- a plurality of option selection parameters;
- a plurality of equality relation parameters;
- a plurality of dependency parameters;
- a plurality of production rule parameters;
- a plurality of logical relation parameters;
- a plurality of inequality expression parameters; and
- a plurality of geometric constraint parameters.

21. The system of Claim 12, wherein said processor is further operable to solve a plurality of simultaneous equations with a Newton-Raphson algorithm or Modified Gram-Schmidt algorithm.

22. A system for integrated decision support,  
comprising:

means for receiving a plurality of decision inputs;

5 means for converting a first plurality of said  
received decision inputs to a plurality of graph  
representations;

means for converting a second plurality of said  
received decision inputs to a plurality of mathematical  
representations;

10 means for decomposing said converted first plurality  
of said received decision inputs and said converted  
second plurality of said received decision inputs to a  
plurality of sub-problems;

15 means for detecting a plurality of strongly-  
connected components associated with said plurality of  
sub-problems; and

means for solving said plurality of sub-problems.

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